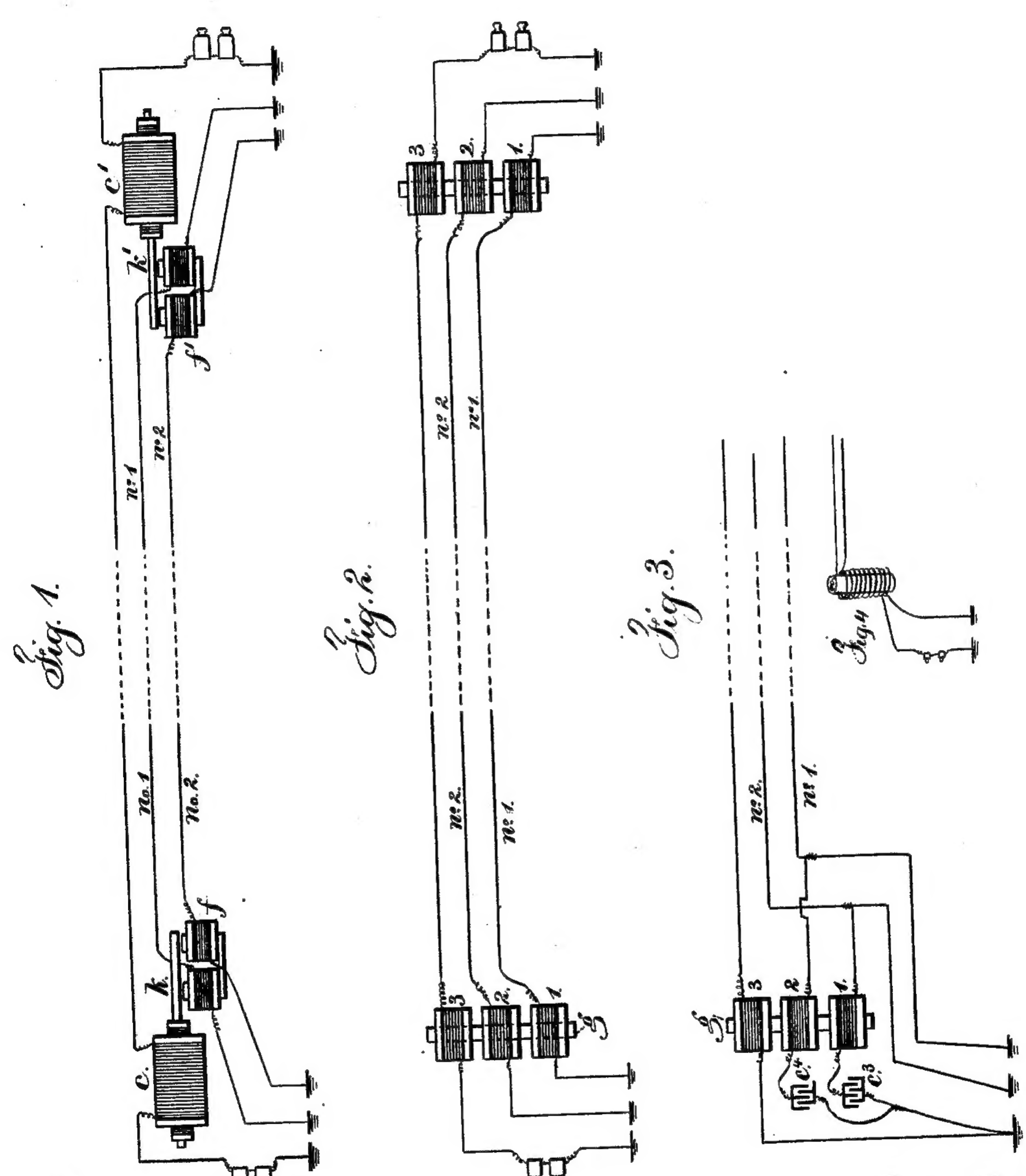
T. A. EDISON.

Circuits for Acoustic or Telephonic-Telegraph.

No. 203,019. Patented April 30, 1878.



Witnesses

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IMPROVEMENT IN CIRCUITS FOR ACOUSTIC OR TELEPHONIC TELEGRAPHS.

Specification forming part of Letters Patent No. **203,019**, dated April 30, 1878; application filed February 21, 1878.

To all whom it may concern:

Be it known that I, THOMAS A. EDISON, of Menlo Park, in the county of Middlesex and State of New Jersey, have invented an Improvement in Circuits for Acoustic Telegraphs, (Case No. 150,) of which the following is a specification:

In telegraph-lines there are very often numerous wires running in the same direction upon the poles, and it has long been known that currents passing through one or more of said wires set up induced currents in the other wires. These ordinarily are harmless in the Morse and other systems of telegraphy; but where a wire for a telephone, acoustic, or speaking telegraph runs parallel to or within the field of the electric influence of another wire, there are false and confusing sounds at the receiving-instrument that greatly interfere with hearing the message sent upon such acoustic lines.

The object of the present invention is to compensate, neutralize, and destroy the extraneous or induced currents from contiguous circuits, so that the messages will not be in any manner interfered with by false currents.

The invention is primarily adapted to telephonic circuits, and is so described herein; but it may be used with any instruments where it is desirable to neutralize such extraneous currents.

The present invention consists in the combination, with the telephonic circuit or other circuit to be freed from external influences, of an induction-coil, connected with the contiguous circuits in such a manner that a reactionary induction is established in the telephonic line of a power corresponding and similar to the primary inductive action, but opposed to the same, so as to entirely oppose and neutralize the action of the same.

In the drawing, Figure 1 is a diagram representing one of the forms in which the aforesaid compensation is effected. The large coils c c' are included in the telephonic circuit at each end of the line. In the coils are iron cores, surrounded by a primary coil, the ends of which may or may not be connected together, according to the compensation desired.

The iron core extends outside of the coils some distance. I have shown compensation for two circuits only. These circuits, which I call "No. 1" and "No. 2," running in close proximity to the telephone-wires for many miles, induce a momentary current in it every time the circuits are opened or closed, the strength of which is proportionate to the proximity of the wires to each other and the number of miles that they run side by side.

These induced currents are in one direction in closing the circuit, and the opposite direction on opening the circuit. To neutralize the induced current from, say, No. 1 circuit, I place electro-magnets e e' at each terminal in the circuit of circuit No. 1.

These magnets are then adjusted to approach the iron cores k k' until the induced current thrown into the coils c and c' and telephone-line by the action of the magnets e and e' is equal, but opposite to, the induced current from the circuit No. 1 thrown into the telephonic wire by running parallel to it. Thus a perfect compensation is attained.

If the two lines run parallel for long distances I connect the two ends of the primary coil on c and c' together, and thus retard the magnetism and demagnetization of the cores k k', and consequently lengthen the induced currents thrown into c and c' by the action of e' and e.

Having thus compensated for circuit No. 1, the compensation for circuit No. 2 is exactly similar. If the latter circuit does not affect the telephone-circuit as strongly as No. 1, the electro-magnets f and f' are placed a greater distance from k and k'; the latter may be elongated, and compensation attained from many circuits by employing separate magnets in each circuit which affects the telephonic circuit.

Owing to the great diversity in the character of the induced currents thrown into telephonic wires from wires in close proximity—due to different lengths and the employment of different battery powers and systems of transmission—many methods to meet special conditions are necessary. Thus in Fig. 2, where the circuits 1 and 2 employ powerful batteries and reversals and many magnets are in circuit, the induced currents thrown into the tele-

phonic wire are exceedingly powerful; hence a more powerful means of compensation is necessary.

In Fig. 2, *g* is an iron core, over which there are three or more coils—one for each line-circuit. The coils 1 and 2 are in the ordinary or Morse circuits Nos. 1 and 2, while coil 3 is in the telephonic circuit. The coils are so wound and arranged, in relation to the induced currents thrown into the telephone-wire by the proximity of the other wires that they will act in the iron core *g* to set up a magnetism therein that will cause a powerful induced current to pass into coil 3 and telephonic line opposite in direction to the induced currents in the telephonic line due to the proximity of the other wires.

It is obvious that these coils may be inserted at any number of points along the line, and that the intensity of the reverse currents will be proportionate to the intensity of the currents exerting the inductive influence, and hence they will always be neutralized.

In cables containing a number of wires there is not only dynamic induction, but static induction. The latter appears sooner than the former, and is of exceedingly short duration, so that magnetic compensation alone is too sluggish. In Fig. 3 is shown a modification of Fig. 1 to meet this condition, which it does to a considerable extent, but not entirely.

The induction-coils 1 and 2 are included in derived circuits from the line-circuits 1 and 2, that pass to the condensers c^3 and c^4, and to the earth. The object of the condensers is to prevent any leakage of current from the circuits 1 and 2, and at the same time to hasten the magnetizing and demagnetizing of the cores *g*, so that an induced current of momentary duration is set up in coil 3 to meet and compensate for the static current from the circuits 1 and 2.

I will here mention that, to obtain perfect compensation, both the static and dynamical induced currents must be set up in the compensations so they will circulate in the telephonic wire in a direction opposite to those induced by proximity of the wires; and to obtain these conditions, both magnets and condensers are necessary—the former to set up dynamical induction-currents, and the latter statical currents.

In my apparatus, if current No 1 is opened there first appears a short wave of current due to static induction, then an interval, and then the dynamical inducted current appears, which gradually dies away to nothing; hence, a compensation which will eradicate the dynamical current will leave that due to static induction free to circulate, and this cannot be eradicated by an induced current from a magnet, because time is required to charge and discharge the cores and the consequent production of the induced current.

Upon short circuits I use a coil with two or more wires, wound side by side upon a wooden bobbin, as shown in Fig. 4. One wire is placed in the telephonic circuit, while the others are placed in the circuits to be compensated for, and so connected therewith that the currents thrown into the telephonic coil are equal but opposite to those due to induction resulting from the wires running parallel.

By employing large wires, and a large quantity of it, I am enabled to obtain nearly perfect compensation, as the coils set up both dynamical and statical currents, no iron cores being used to retard the appearance of the currents.

Instead of the coil of several wires wound side by side, several long strips of tin-foil may be placed side by side and insulated from each other, and the currents passed through the strips in the same manner as if they were wires.

Another method consists in providing the telephonic receivers with differential coils, and running another wire parallel with the telephonic wires, and including in it the subsidiary coil.

I claim as my invention—

The method herein specified of compensating in one circuit for induced currents from adjacent circuits, consisting in setting up a reactionary induction by an induction-coil connected with the adjacent circuit or circuits, substantially as set forth.

Signed by me this 13th day of February, A. D. 1878.

THOS. A. EDISON.

Witnesses:
GEO. T. PINCKNEY,
CHAS. H. SMITH.